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NATIONAL DAM SAFETY PROGRAM. ELLIOT DAVIS LAKE DAM (MO 10129), --ETC(U)
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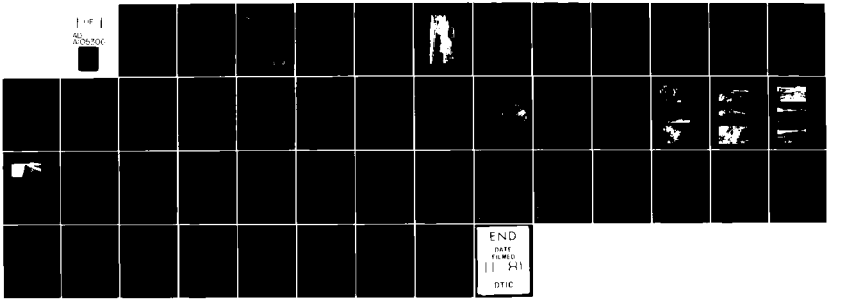

MISSOURI LEVEL II PS

MISSOURI-KANSAS CITY BASIN

ELLIOT DAVIS LAKE DAM

HOWARD COUNTY, MISSOURI

MO 10129

AD A105306

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY: HOSKINS-WESTERN-SONDEREGGER, INC.

FOR: STATE OF MISSOURI

SEPTEMBER, 1978

UNCLASSIFIED
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REPORT DOCUMENTATION PAGE

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National Dam Safety Program
Elliot Davis Lake Dam (MO 10129)
Howard County, Missouri

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8. CONTRACT OR GRANT NUMBER(s)
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Elliot Davis Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Elliot Davis Lake dam:

It was prepared under the National Program of Inspection of Non-Federal Dams

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream

SIGNED 12 MAR 1979

SUBMITTED BY: _____ _____
Chief, Engineering Division Date

SIGNED

APPROVED BY: _____ 12 MAR 1979
Colonel, CE, District Engineer Date

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Elliot Davis Lake Dam
State Located	Missouri
County Located	Howard County
Stream	Tributary to Adams Fork
Date of Inspection	September 14, 1978

Elliot Davis Lake Dam was inspected by an interdisciplinary team of engineers, ~~from Hoskins-Western-Sonderegger, Inc.~~ The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate size dam with a high downstream hazard potential. Failure would threaten life and property. The estimated damage zone extends three miles downstream of the dam. Within the first two miles downstream of the dam are three to four houses, one county road, one state road and one railroad crossing.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will not pass the flood expected to be exceeded once in one hundred years without overtopping the dam. The spillway will pass 17% of the Probable Maximum Flood without overtopping the dam. The Probable Maximum Flood (PMF) is defined as the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These analyses should be obtained in the future.

Other deficiencies visually observed by the inspection team were willows growing along the waterline on upstream slope, seepage emerging from the toe of the dam near the right abutment, water ponded downstream of the dam in the area of the seep, dense growth of grass and rushes enclosing the concrete weir inlet to the spillway, erosion around the outlet end of the spillway, a reported break in the spillway pipe, and the lack of an emergency spillway.

Several items of preventive maintenance need to be initiated by the owner. These are described in detail in the body of the report.

H. P. Hoskins

Harold P. Hoskins, P.E.
Hoskins-Western-Sonderegger, Inc.
Lincoln, Nebraska

PHOTO NO. 1
OVERVIEW TAKEN
FROM RIGHT SIDE

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ELLIOT DAVIS LAKE DAM
ID NO. MO. 10129

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, Dictrict Engineer directed that a safety inspection of the Elliot Davis Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams." These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) This dam is an earth fill about 1050 feet in length and 42 feet in height. Topography around the dam is moderately steep. Materials on the slopes consist of loess or re-worked loess soils underlain by limestone. Surface materials in the dam are lean clays (CL).

(2) The spillway consists of a 30 inch diameter corrugated metal pipe (CMP) riser connected to a 12 inch CMP outlet passing through the dam and/or abutment on the right (south) end.

(3) A 4 inch steel pipe with a valve at the downstream end passes through the base of the dam at about centerline station 7+00.

(4) Pertinent physical data are given in Paragraph 1.3 below.

b. Location. The dam is located in the central portion of Howard County, Missouri, as shown on Plate 2. The dam is shown on Plate 1 in the SW¼ of Section 10, T50N, R16W. The lake formed by the dam is shown in the W½ of Section 10 and the E½ of Section 9, T50N, R16W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends three miles downstream of the dam. Within the first two miles downstream of the dam are three to four houses, one county road, one state road and one railroad crossing.

e. Ownership. This dam is owned by Westown Lake, Inc., 124 East Morrison, Fayette, Missouri 65248. Attention: John Edwards.

f. Purpose of Dam. The dam forms a 47 acre ± recreational lake.

g. Design and Construction History. No design or construction data were available. The dam was constructed in 1962 for Mr. Elliot Davis. It was reported that materials for the dam came from the reservoir area, that it has a foundation cut off and that a sheepsfoot roller was used to compact the fill.

h. Normal Operating Procedure. There are no controlled outlet works for this dam. No information was available on the fluctuation of the lake level. It was reported that flow passed over the top of the dam for about 2 hours in 1973. This overtopping resulted from a 9 to 12 inch rain in the area.

1.3 PERTINENT DATA

a. Drainage Area - 0.55 sq. mi. (351.3 acres).

b. Discharge at Damsite.

(1) All discharge at the damsite is through a 30 inch CMP drop inlet pipe (capped with a 30 inch square concrete weir) with a 12 inch CMP conduit outlet pipe.

(2) Estimated flood at damsite - 300 c.f.s.± in 1973; based on estimated depths furnished by owner over the low portions at the dam and using current rating.

(3) The principal spillway capacity varies from 0 c.f.s. at elevation 699 ft. to 7 c.f.s. at elevation 701.2 feet (low point on dam crest and maximum pool elevation).

(4) There is no emergency spillway.

c. Elevations (Feet above M.S.L.)

(1) Top of dam (low point) - 701.2; normal - 703.
(2) Principal spillway crest - 699.0.
(3) Emergency spillway crest - None.
(4) Streambed at centerline of dam - 660±.
(5) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 3,600 ft.±.

e. Storage (Acre-feet).

(1) Top of dam (701.2 feet) - 895.
(2) Normal pool (699.0 feet) - 778.

f. Reservoir Surface (Acres)

(1) Top of dam - 51±.
(2) Spillway crest - 47±.

g. Dam

(1) Type - Earth embankment.
(2) Length - 1050 feet±.
(3) Height - 42 feet±.
(4) Top width - 18 feet.
(5) Side Slopes.

(a) Downstream - 3.1H to 3.5H on 1V (measured)
(b) Upstream - Exposed section - 3.8H on 1V (measured)
Reported to be 4H on 1V

(6) Zoning - Unknown.
(7) Impervious Core - Unknown.
(8) Cutoff - Reported as present.
(9) Grout curtain - unknown.
(10) Wave Protection - Riprap, limestone rock.

h. Diversion and regulation - None

i. Spillway

(1) Principal

(a) Type - 30 inch CMP drop inlet with concrete weir cap and 12 inch CMP outlet conduit.
(b) Size of weir - 30 inch square opening.
(c) Crest elevation - 699.0 feet, M.S.L.

(2) Emergency - None.

j. Regulating Outlet - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No design data were available.

2.2 CONSTRUCTION

The dam was constructed in 1962. No construction data were available. It was reported that the embankment was compacted with sheepsfoot rollers.

2.3 OPERATION

No data on operation of the spillway were available. It was reported that the dam overtopped in 1973.

2.4 EVALUATION

a. Availability. No data were available.

b. Seepage and Stability Analyses. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Davis Lake Dam was made on September 14, 1978. Engineers from Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska making the inspection were: Rey Decker, Geology and Soil Mechanics; Garold Ulmer, Civil Engineer; Richard Walker and Gordon Jamison, Hydrology. Specific observations are discussed below.

b. Dam. Rough measurements along the crest of the dam indicate that the ends of the dam are 1 to 2 feet lower in elevation than the central section of the dam.

The upstream slope appears to be quite flat (measured at 3.8H on 1V) and is covered from the waterline down with durable limestone riprap up to 36 inches in diameter. No bedding material was noted under the riprap. A few small willows were observed along the waterline. No excessive erosion was noted on the upstream slope. The downstream slope is covered with a dense growth of grasses and clover that made it difficult to evaluate surface conditions. The abutments are mantled with silty clay (CL) soils. However, limestone bedrock outcrops at and above the water level toward the upper end of the lake. No animal burrows, cracks, slides or abnormal deformations were noted on the embankment or abutments.

A fairly large seepy area, approximately 20x75 feet in size, was observed at the downstream toe of the dam near the right abutment-embankment trough downstream from about center line station 8+50 (see Appendix C for stationing). Water was ponded in the lower part (approximately 20x20 feet) of this area and the ground surface was very unstable.

c. Appurtenant Structures. The principal spillway consists of a 30 inch corrugated metal riser connected to a 12 inch CMP outlet passing through the dam or abutment at about ℄ station 10+50. A dense growth of tall grass and rushes encloses the screen around the concrete weir inlet to the spillway. The spillway outlets on the right abutment about 13 feet above the elevation of the valley floor. A hole about 20 feet in diameter has eroded around the outlet end and exposed about 4 feet of the spillway pipe. The exposed c/m pipe appeared to be in good condition. However, it was reported by one of the owners that the 12 inch spillway conduit pipe is broken and leaks. Leakage from the spillway outlet could contribute to the seep area along the toe of the dam.

The water level in the reservoir was at the elevation of the spillway weir crest at the time of inspection with a slight trickle of water discharging from the spillway outlet.

A 4 inch steel pipeline passes through the base of the dam at about center line station 7+00. This pipeline outlets near the downstream toe of the dam and is controlled by a valve at the outlet end. It was reported that this valve is opened once or twice each year to be sure that it is operable.

d. Reservoir Area. No wave wash, excessive erosion or slides were noted along the shoreline of the reservoir.

e. Downstream Channel. The spillway outlets onto a well vegetated slope and thence into a wooded channel approximately 400 feet downstream from the dam.

f. Downstream Hazards. Downstream hazards are described in Section 5. In addition to those in Section 5, it was noted that a sewage lagoon approximately 250 x 50 feet is located in the valley floor downstream from about ℄ station 7+00. It was reported that additional lagoons are to be constructed adjacent to the present lagoon.

3.2 EVALUATION

The erosion around and leakage in the spillway outlet could lead to potential of failure if left uncorrected. Additional studies would be required to determine the affect of seepage on stability of the dam. The flat side slopes on this embankment would ordinarily provide adequate safety against shear failures for a dam of this height.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam. It was reported that water flowed over the top of the dam in 1973.

4.2 MAINTENANCE

The growth of small trees and shrubs on the upstream face of the dam, heavy grass growth on the downstream slope, erosion at the spillway outlet, and reported leaks in the spillway conduit indicate the lack of regular maintenance.

4.3 MAINTENANCE AND OPERATING FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any warning system in effect for this dam.

4.5 EVALUATION

A potential of failure may result if deficiencies in the spillway and control of tree growth on the upstream face are not corrected.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. No design data were found for this dam.

b. Experience Data. The drainage area, lake surface area, and elevation-storage data were developed from the USGS Fayette, Mo. 7 1/2 minute topographic quadrangle map. The hydraulic computations for spillway and dam overtopping discharge ratings were based on data obtained from surveys made at the time of the field inspection.

c. Visual Observations.

(1) The principal spillway outlet channel is eroded and the approach to the weir is blocked by heavy grass matted against the protective fence. It was also reported that the spillway outlet conduit is broken and leaks.

d. Overtopping Potential. The principal spillway is too small to pass either the 100-year or one-half probable maximum flood without overtopping. The principal spillway will pass the 0.17 PMF without overtopping the dam. The results of the routings through the reservoir are tabulated in regards to the following conditions.

Frequency	Peak Inflow Discharge c.f.s.	Peak Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 701.2	Time Dam Overtopping Hrs.
100-Yr.	690	110	701.8	-0.6	14+
1/2 PMF	1660	1400	702.9	-1.7	14+
PMF	3340	3220	703.5	-2.3	15+
0.17 PMF	530	9	701.2	0	-

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and a intermediate size. Therefore, the PMF is the test for the adequacy of the dam and its spillways.

The St. Louis District, Corps of Engineers, in a letter dated 11 August, 1978 has estimated the damage zone as extending three miles downstream from the dam. Within the damage zone are three to four homes, one county road, one state highway and one railroad crossing.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of features which could adversely affect structural stability of this dam are discussed in Section 3.

b. Design and Construction Data. No data were available.

c. Operating Records. There are no controlled outlets for this dam.

d. Post Construction Changes. The inspection team is not aware of any post construction changes on this dam.

e. Seismic Stability. This dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to cause a structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The erosion and reported leakage associated with the spillway outlet should be corrected. The flatter than normal embankment slopes should provide adequate safety against shear failures in a dam of this height. However, additional studies would be required to determine the effects of the observed seepage on the stability of the dam. The floods caused by the 100-year storm will overtop the dam to a depth of 0.6 foot and the 0.5 probable maximum flood will overtop the dam to a depth of 1.7 feet.

b. Adequacy of Information. Due to the lack of engineering data, the conclusions in this report are based upon performance history and visual observations. These data are considered sufficient to support these conclusions. Neither seepage nor stability analysis were found which is a deficiency that should be corrected in the future.

c. Urgency. The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the deficiencies in the present spillway listed in paragraph "a" are not corrected, they could ultimately lead to potential of failure.

d. Necessity for Phase II. Phase II investigations do not seem to be necessary. However, additional engineering data should be obtained at the owner's expense to evaluate the effects of seepage on the stability of the dam.

e. Seismic Stability. An earthquake of the magnitude expected in this area should not be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives.

(1) Raising the low sections on each end of the dam up to the normal crest elevation of 703 would prevent overtopping by the 0.5 PMF.

(2) An emergency spillway should be constructed to pass the probable maximum flood without overtopping the dam.

(3) If the present spillway is to remain in service, the outlet pipe should be repaired. The erosional damage at the outlet end of the spillway should be corrected and measures taken to control erosion from future spillway discharges.

(4) Seepage and stability analyses comparable to the requirements of the guidelines should be performed.

(5) The services of an engineer experienced in the design of dams should be obtained to evaluate seepage and stability conditions and to design the new spillway and/or modifications to the embankment that are required to prevent overtopping of the dam and erosion from spillway discharges.

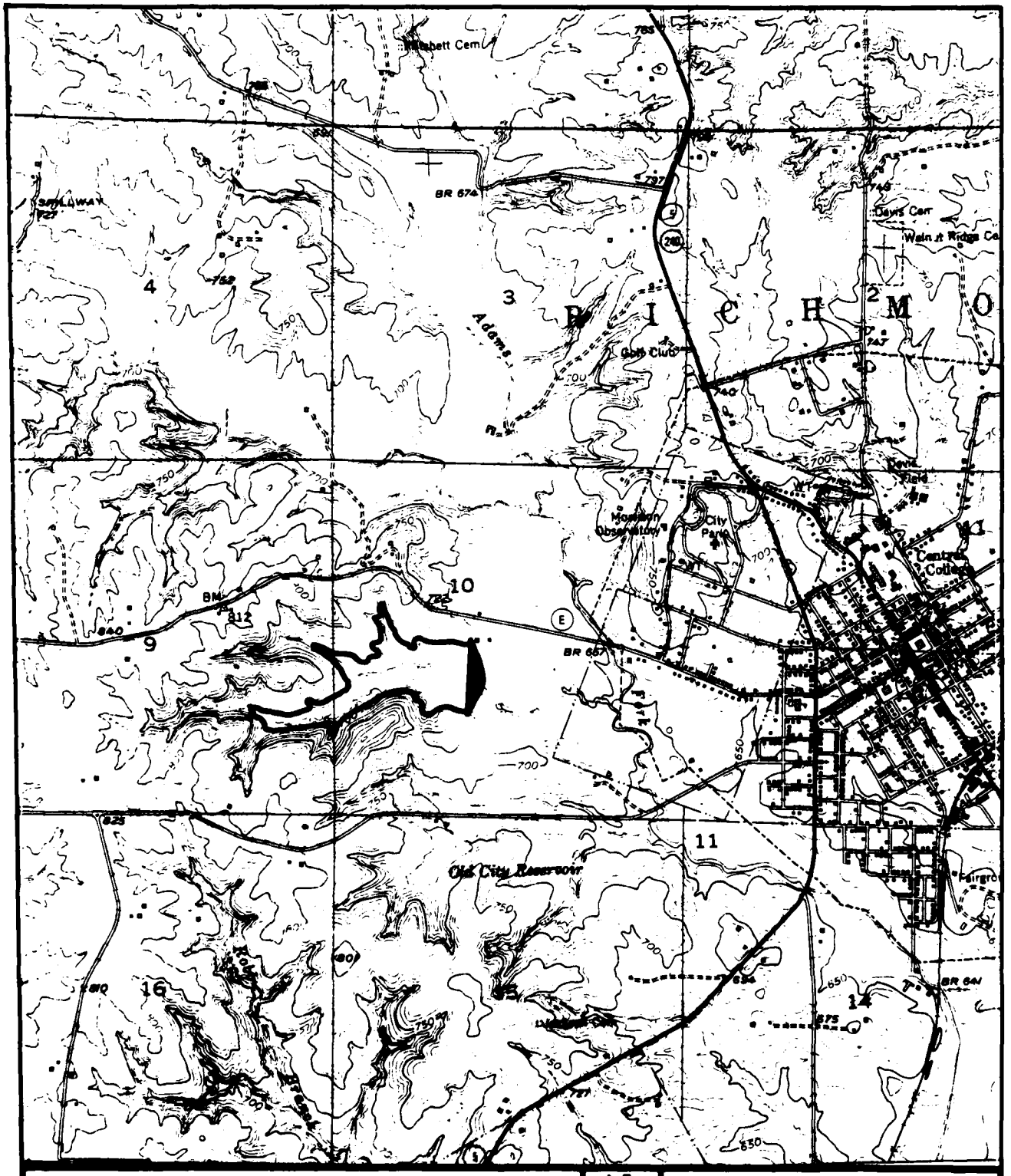
b. O & M Maintenance and Procedures.

(1) The deficiencies in the present spillway and the tree growth on the upstream face of the dam should be corrected.

(2) Mowing the downstream slope of the dam would allow better evaluation of downstream slope conditions.

(3) A schedule of regular inspection and maintenance should be initiated. Maintenance measures should include control of vegetation on the structure and of excessive erosion in the present and/or new spillway.

APPENDIX A
MAPS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PECHMO
Adams
Golf Club
Mountain Observatory
City Park
Central College
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BR 667
11
Old City Reservoir
Fairgrounds
16
14
BR 64N
SCALE IN FEET
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SCALE IN METERS
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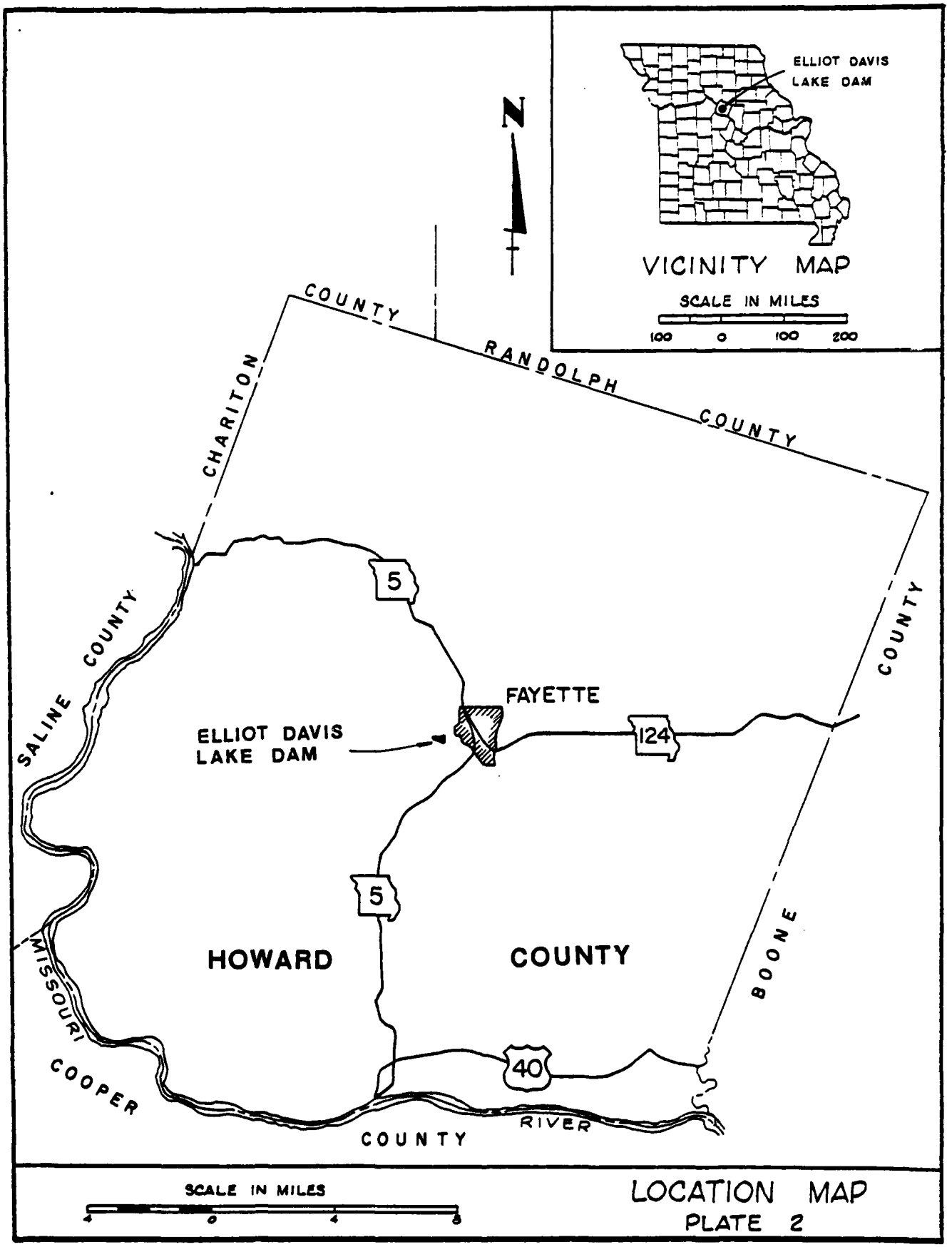
ELLIOT DAVIS
LAKE DAM
VICINITY TOPOGRAPHY
PLATE 1



LOCATION MAP
PLATE 2

APPENDIX B
PHOTOGRAPHS

PHOTO NO. 2
SEEPAGE SPRING
OPPOSITE STA. 8+85

PHOTO NO. 3
OVERVIEW OF DAM
TAKEN UPSTREAM
FROM RIGHT ABUTMENT.

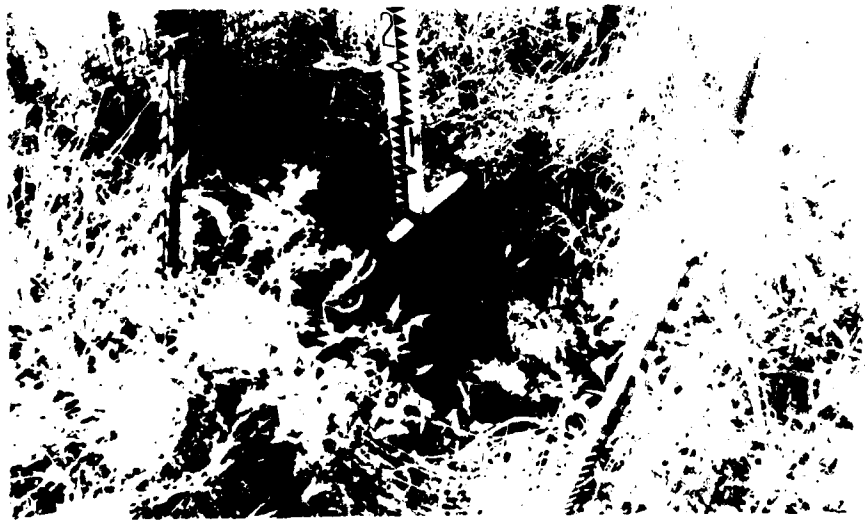


PHOTO NO. 4
PRINCIPAL SPILLWAY
INLET.

PHOTO NO. 5
DOWNSTREAM SLOPE
OF DAM.

PHOTO NO. 6
OUTLET END OF
PRINCIPAL SPILLWAY

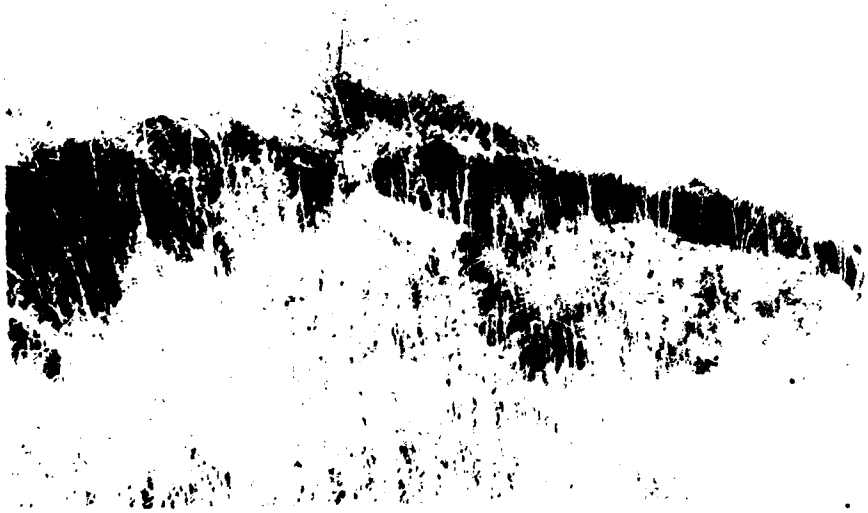


PHOTO NO. 7
OUTLET END 4" PIPE
WITH VALVE CONTROL

PHOTO NO. 8
LOOKING DOWNSTREAM
FROM CENTERLINE
STATION 7+00

PHOTO NO. 9
LOOKING UPSTREAM
ACROSS RESERVOIR
FROM STATION 7+00.

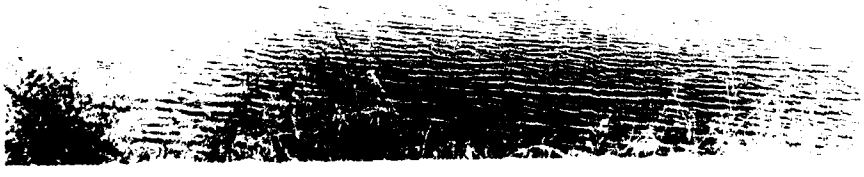
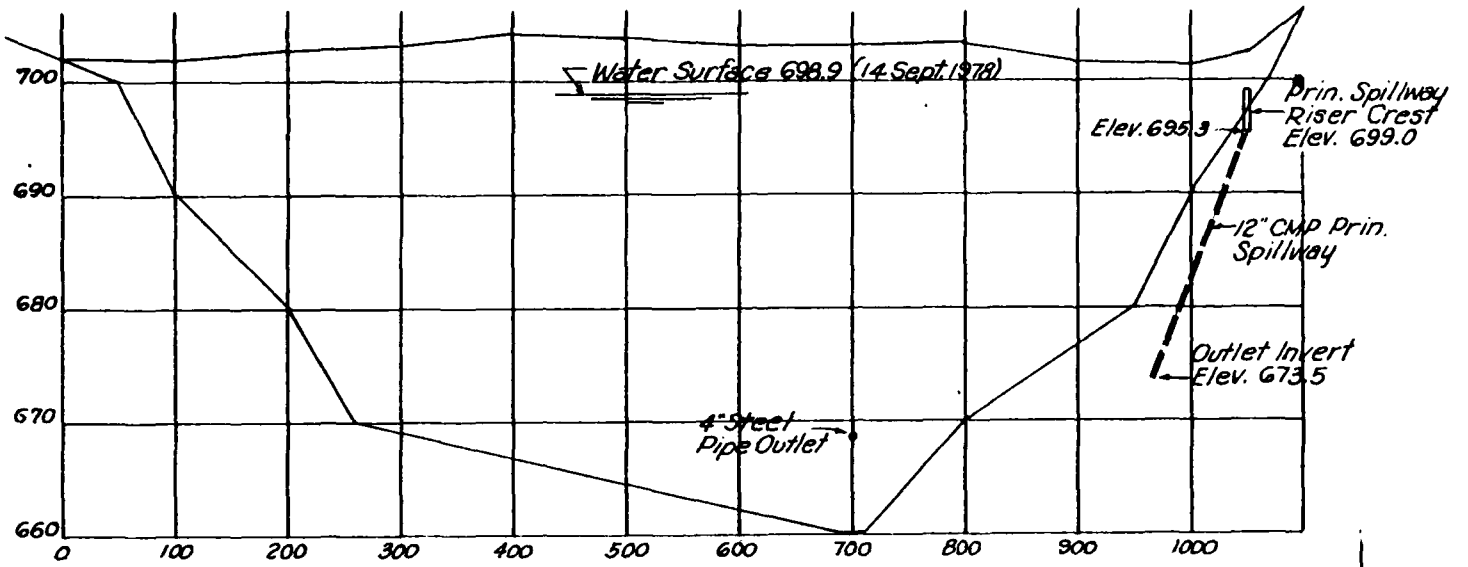


PHOTO NO. 10
UPSTREAM SLOPE
FROM LEFT ABUTMENT.

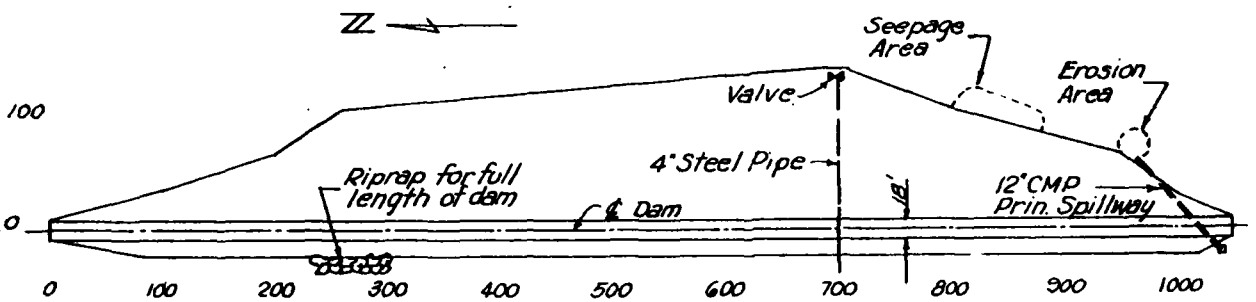
PHOTO NO. 11
CREST OF DAM
TAKEN FROM
LEFT ABUTMENT

APPENDIX C
PLAN, SECTION AND PROFILE

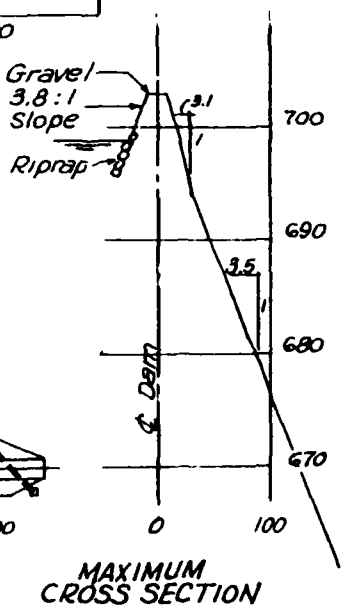


PROFILE OF DAM

ELLIOT DAVIS LAKE DAM
NATIONAL DAM SAFETY PROGRAM
PHASE I



PLAN OF DAM



MAXIMUM CROSS SECTION

APPENDIX D
HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Mockes dimensionless standard curvalinear unit hydrograph and the SCS TR-20 program were used to develop the inflow hydrographs (see Plate D1). The inflow hydrograph for the 100-year flood was generated by the consultant using the TR-20 program.

a. Six-hour, twelve-hour, and twenty-four hour 100-year rainfall for the dam location was taken from NOAA Technical Paper 40. The 24-hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current Corps of Engineers and St. Louis District policy and guidance for hydraulics and hydrology.

b. Drainage area = 0.55 square mile.

c. Time of concentration of runoff = 31 minutes.

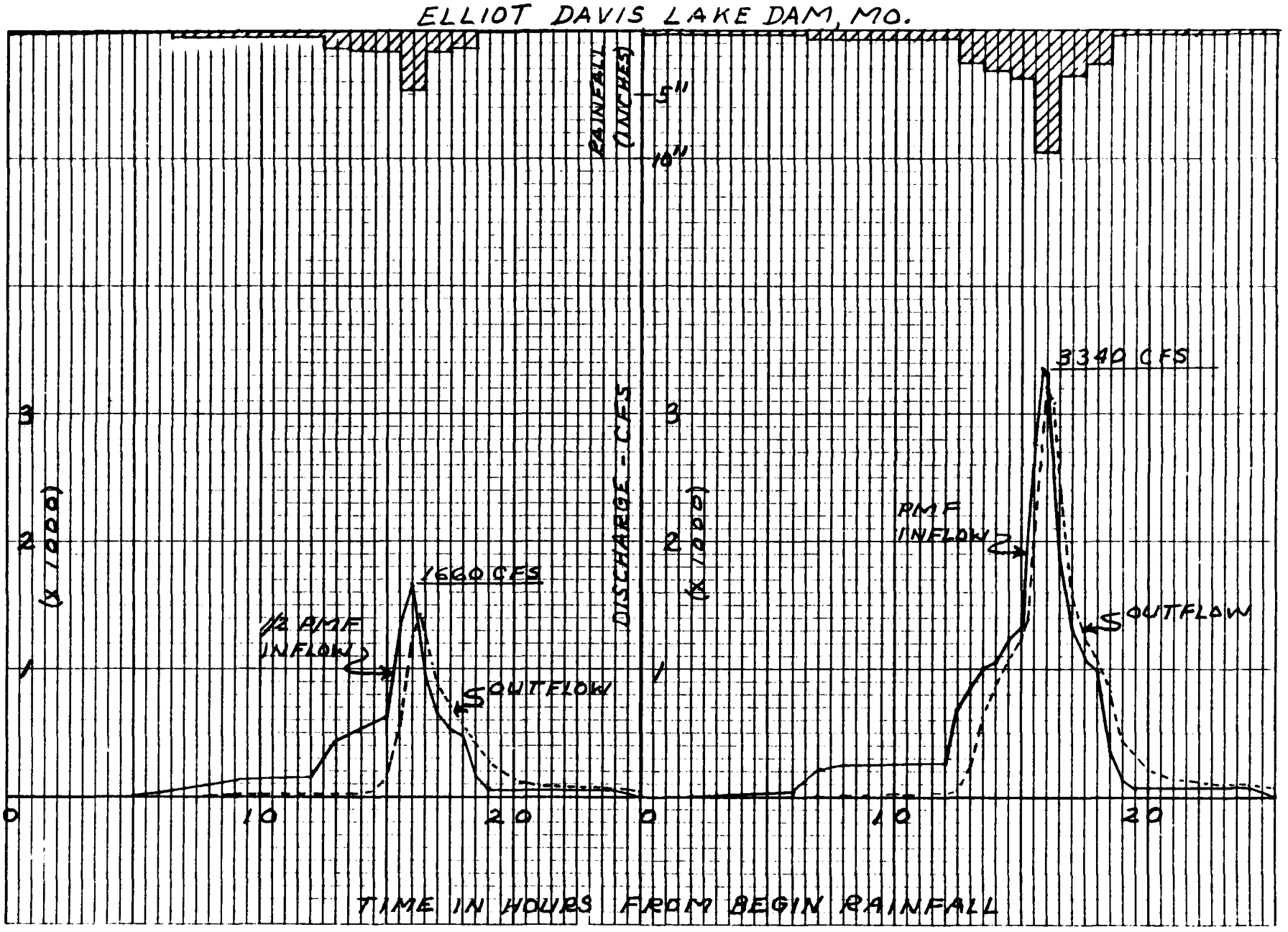
d. The antecedent storm conditions were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMCIII). The initial pool elevation was assumed at the crest of the principal spillway.

e. The total 24-hour storm duration losses for the 100-year storm were 1.14 inches. The total losses for the 24-hour duration 1/2 PMF storm were 1.23 inches. The total losses for the PMF storm were 1.27 inches. These data are based on use of soils groups B and D; grazing, homesites, and woodlands weighted to produce SCS input runoff curve No. 79 from SCS AMCII converted by TR-20 to computed curve No. 90.4 SCS AMCIII.

f. Average soil loss rates = 0.05 inch per hour approximately.

2. The weir/drop-inlet discharge ratings were developed using standard formulas. The flows over the dam crest were based on the broad-crested weir equation $Q = CLH^{3/2}$, where H is the head on the dam crest; the coefficient C, which varies with head, was taken from the USGS publication "TWRI, Book 3, Chapter 5, Measurement of Peak Discharge at Dams by Indirect Methods" (C values varied from 2.52 to 3.04). Sample calculations are attached.

3. Floods were routed through the reservoir using the TR-20 program to determine the capabilities of the spillway and dam embankment crest. The unit hydrograph computation duration interval is computed as 0.17 Tc by the TR-20 program. Copies of the input-output data from the TR-20 program used to develope the hydrographs for the PMF, 0.5 PMF, and 100-year flood are attached. The storm rainfall patterns, inflow hydrographs and routed outflow hydrographs are shown on Plate D1.



HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1968

MO DAM INSP-ELLIOT DAVIS DAM

EXECUTIVE CONTROL CARD OPERATION LIST

MO DAM INSP-ELLIOT DAVIS DAM

C TABLE VELOCITY INCREMENT = 0.200

8	0.0000	0.0800	0.1800	0.2500	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6800	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9400	0.9300
9 ENDTBL					

STRUCTURE NO. 1

	ELEVATION	DISCHARGE	STORAGE
8	699.0001	0.0000	777.9998
9 ENDTBL			

DIMENSIONLESS HYDROGRAPH - DELTA T =484.00

8	0.0000	0.0300	0.1000	0.1900	0.3100
8	0.4700	0.6600	0.8200	0.9300	0.9900
8	1.0000	0.9900	0.9300	0.8600	0.7800
8	0.6800	0.5600	0.4600	0.3900	0.3300
8	0.2800	0.2410	0.2070	0.1740	0.1470
8	0.1260	0.1070	0.0910	0.0770	0.0660
8	0.0550	0.0470	0.0400	0.0340	0.0290
8	0.0250	0.0210	0.0180	0.0150	0.0130
8	0.0110	0.0090	0.0080	0.0070	0.0060
8	0.0050	0.0040	0.0030	0.0020	0.0010
8	0.0000	0.0000	0.0000	0.0000	0.0000
9 ENDTBL					

RAINFALL TABLE NO. 1 TIME INCREMENT = 0.50

8	0.0000	0.0080	0.0170	0.0260	0.0350
8	0.0450	0.0550	0.0650	0.0760	0.0870
8	0.0990	0.1120	0.1250	0.1400	0.1560
8	0.1740	0.1940	0.2190	0.2540	0.3030
8	0.5150	0.5830	0.6240	0.6540	0.6820
8	0.7050	0.7270	0.7480	0.7670	0.7840
8	0.8000	0.8160	0.8300	0.8440	0.8570
8	0.8700	0.8820	0.8930	0.9050	0.9160
8	0.9260	0.9360	0.9460	0.9550	0.9650
8	0.9740	0.9830	0.9920	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 2 TIME INCREMENT = 0.02

8	0.0000	0.0100	0.0200	0.0200	0.0300
8	0.0400	0.0500	0.0600	0.0700	0.0800
8	0.1000	0.1100	0.1300	0.1400	0.1700
8	0.1900	0.2200	0.2700	0.3500	0.4400
8	0.5200	0.6000	0.6300	0.6600	0.6800
8	0.7000	0.7200	0.7400	0.7600	0.7700
8	0.7900	0.8000	0.8200	0.8300	0.8400
8	0.8500	0.8700	0.8800	0.8900	0.9000
8	0.9100	0.9200	0.9300	0.9400	0.9500
8	0.9567	0.9633	0.9700	0.9800	0.9900
8	1.0000	1.0000	1.0000	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 3 TIME INCREMENT = 0.50

8	0.0000	0.0700	0.1400	0.2100	0.2800

V

8	0.3500	0.4300	0.5000	0.5800	0.6500
8	0.7300	0.8000	0.8400	1.2700	1.6400
8	2.0500	2.4400	2.8300	3.2200	3.6100
8	4.0000	4.4000	4.7900	5.1800	5.5800
8	6.8400	8.1000	9.6100	11.1200	13.0100
8	14.9000	19.6800	24.4700	26.2400	28.0000
8	29.3800	30.7700	30.8600	30.9900	31.1000
8	31.2100	31.3200	31.4300	31.5400	31.6500
8	31.7600	31.8800	32.0000	32.1100	32.1100
9 ENDTBL					

STANDARD CONTROL INSTRUCTIONS

SUBRTN	XSECTN	STRCT	HYDROGRAPHS IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	OUTPUT OPTIONS PK	H	E	V	PH	SM
RUNOFF	0	1	0	0	6	0.550	79.000	0.500	1	1	0	1	0	0
RESVOR	0	1	6	0	7	699.000	0.000	0.000	1	1	1	1	0	0

ENDATA

END OF LISTING

ADDITIONS TO TABULAR DATA FOLLOW

STRUCTURE NO. 1

0	699.0001	0.0000	778.0001
0	699.2000	5.1000	788.0001
0	699.4000	7.1000	800.0001
0	699.6000	7.1000	805.0001
0	700.0001	7.1000	828.0001
0	700.5001	7.2000	855.0001
0	701.0001	7.3000	881.0001
0	701.2000	7.3000	895.0001
0	701.4000	15.3000	907.0001
0	701.6000	43.4000	914.0001
0	701.8000	103.0000	927.0001
0	702.2000	327.0000	948.0001
0	702.7000	928.0001	977.0001
0	703.2000	1937.0002	1005.0001
0	704.2000	6121.0009	1062.0002

EXECUTIVE CONTROL CARD OPERATION INCRELM, MAIN TIME INCREMENT= 0.25
EXECUTIVE CONTROL CARD OPERATION CONRUT, FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

PMF

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.55 INPUT RUNOFF CURVE= 79.0 TIME OF CONCENTRATION= 0.52
COMPUTED CURVE NO. = 90.4

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
5.30	28.935	(RUNOFF)
10.69	269.265	(RUNOFF)
15.92	3342.535	(RUNOFF)
23.42	84.883	(RUNOFF)

HYDROGRAPH, TZERO= 1.75 DELTA T= 0.25 DRAINAGE AREA= 0.55

TIME											
1.75	DISCHG	0.00	1.66	4.05	6.62	9.53	12.853	15.17	16.47	18.61	21.60 4
4.25	DISCHG	25.13	23.42	25.07	27.875	28.90	28.48	29.82	33.336	70.25	144.01
6.75	DISCHG	184.92	206.227	219.33	228.51	255.35	240.688	245.04	248.65	251.68	254.23 9
9.25	DISCHG	256.41	258.29	259.92	261.3710	264.27	266.49	269.16	267.3611	266.91	267.22
11.75	DISCHG	269.43	276.9912	424.50	698.64	821.01	861.3713	918.64	1005.03	1043.00	1056.65 14
14.25	DISCHG	1126.87	1253.47	1307.79	1336.6715	1839.90	2788.26	3194.72	3314.7816	2836.82	1068.85
16.75	DISCHG	1446.50	1308.0217	1197.58	1060.11	1003.98	980.6518	760.86	340.45	160.05	105.06 19
19.25	DISCHG	85.18	79.47	77.95	77.9520	77.95	77.95	77.95	77.9421	77.95	77.95
21.75	DISCHG	77.95	77.9522	77.95	77.99	79.72	83.0023	84.39	84.79	83.20	79.62 24
24.25	DISCHG	59.24	22.70	7.20	2.2225	0.63	0.13	0.00	0.0026		

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 32.11 / 30.8452 / 1.17 CFS-HRS= 10948.62 ACRE-FT= 904.79

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 699.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
16.06	3215.367	703.50

HYDROGRAPH, TZERO= 1.75 DELTA T= 0.25 DRAINAGE AREA= 0.55

TIME											
1.75	DISCHG	0.00	0.00 2	0.02	0.05	0.10	0.17 3	0.26	0.36	0.47	0.60 4
1.75	ELEV	699.00	699.00	699.00	699.00	699.00	699.01	699.01	699.02	699.03	699.03
4.25	DISCHG	0.74	0.88	1.03	1.19 5	1.36	1.54	1.72	1.91 6	2.22	2.69
4.25	ELEV	699.04	699.05	699.06	699.07	699.08	699.09	699.11	699.12	699.14	699.16
6.75	DISCHG	3.99	5.30 7	6.73	7.09	7.09	7.09 8	7.09	7.09	7.09	7.11 9
6.75	ELEV	699.24	699.31	699.38	699.39	699.39	699.39	699.39	699.39	699.39	700.08
9.25	DISCHG	7.13	7.15	7.17	7.19 10	7.21	7.23	7.25	7.2611	7.29	7.29
9.25	ELEV	700.18	700.27	700.37	700.47	700.57	700.67	700.77	700.86	700.96	700.99
11.75	DISCHG	7.29	8.05 12	11.57	45.97	119.53	262.79 13	454.15	620.24	762.64	865.81 14
11.75	ELEV	700.99	701.22	701.34	701.40	701.82	702.08	702.28	702.44	702.56	702.64
14.25	DISCHG	952.77	1081.57	1189.57	1261.54 15	1430.81	1913.69	2869.58	3196.30 16	3092.36	2459.47
14.25	ELEV	702.71	702.77	702.82	702.86	702.95	703.18	703.41	703.50	703.47	703.32
16.75	DISCHG	1830.19	1584.45 17	1404.50	1254.94	1134.00	1050.23 18	989.16	804.18	604.42	490.50 19
16.75	ELEV	703.14	703.02	702.93	702.86	702.80	702.76	702.71	702.59	702.43	702.37

19.25	DISCHG	322.12	274.52	235.64	204.34 20	179.25	159.13	143.02	130.10 21	119.79	111.99
19.25	ELEV	702.19	702.10	702.03	701.98	701.93	701.90	701.87	701.84	701.82	701.80
21.75	DISCHG	104.79	101.39 22	99.27	97.34	95.67	94.37 23	93.41	92.61	91.83	90.92 24
21.75	ELEV	701.80	701.79	701.78	701.78	701.77	701.77	701.76	701.76	701.76	701.75
24.25	DISCHG	88.95	84.61	78.31	71.65 25	65.30	59.43	54.06	49.17 26	44.72	40.68
24.25	ELEV	701.75	701.73	701.71	701.69	701.67	701.65	701.63	701.61	701.60	701.58

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 26.2071 CFS-HRS= 9302.29 ACRE-FT= 768.71

ENDCMP 1

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSLCTN/STRUCT 0/ 1 TO XSLCTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 0.50 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 2

0.5 PMF

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.55 INPUT RUNOFF CURVE= 79.0 TIME OF CONCENTRATION= 0.52
COMPUTED CURVE NO. = 90.4

PEAK TIMES PEAK DISCHARGES PEAK ELEVATIONS
10.85 122.900 (RUNOFF)
15.92 1659.615 (RUNOFF)
23.42 42.309 (RUNOFF)

HYDROGRAPH, TZERO= 3.50 DELTA T= 0.25 DRAINAGE AREA= 0.55

TIME											
3.50	DISCHG	0.00	1.28	2.20	2.99	3.55	4.31	5.295	5.91	6.20	6.36
6.00	DISCHG	8.076	18.55	41.45	57.75	68.997	77.59	84.53	90.27	95.10	99.23
8.50	DISCHG	102.80	105.90	108.619	110.99	113.10	114.97	116.650	118.90	121.64	122.76
11.00	DISCHG	122.67	123.11	123.85	125.42	129.472	199.64	330.65	391.05	412.705	419.63
13.50	DISCHG	486.59	507.03	515.154	551.40	615.00	643.11	656.615	908.68	1379.94	1504.06
16.00	DISCHG	1646.086	1410.14	929.56	719.87	651.227	596.41	526.07	500.20	402.647	379.18
18.50	DISCHG	169.67	79.77	51.374	42.46	39.61	36.85	36.850	36.85	38.35	38.85
21.00	DISCHG	38.852	38.85	38.85	38.85	38.852	38.85	38.88	39.74	41.372	42.07
23.50	DISCHG	42.27	41.47	39.692	29.53	11.31	3.59	1.102	0.31	0.06	0.00
26.00	DISCHG	0.002									

1406
TOTAL WATER, IN INCHES ON DRAINAGE AREA= 14.8353 CFS-HRS= 5265.87 ACRE-FT= 485.17
7.24

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 699.00

PEAK TIMES PEAK DISCHARGES PEAK ELEVATIONS
16.25 1404.984 702.93

HYDROGRAPH, TZERO= 3.50 DELTA T= 0.25 DRAINAGE AREA= 0.55

TIME											
3.50	DISCHG	0.00	0.00	0.014	0.03	0.05	0.07	0.105	0.14	0.15	0.16
3.50	ELEV	699.00	699.00	699.00	699.00	699.00	699.00	699.00	699.00	699.01	699.01
6.00	DISCHG	0.266	0.35	0.53	0.85	1.257	1.71	2.21	2.76	3.338	3.92
6.00	ELEV	699.016	699.02	699.03	699.05	699.08	699.11	699.14	699.17	699.21	699.24
8.50	DISCHG	4.66	5.34	6.049	6.75	7.09	7.09	7.090	7.09	7.09	7.09
8.50	ELEV	699.27	699.31	699.34	699.38	699.39	699.39	699.39	699.39	699.39	699.39
11.00	DISCHG	7.09	7.09	7.09	7.09	7.092	7.09	7.11	7.14	7.173	7.20
11.00	ELEV	699.39	699.39	699.39	699.39	699.39	699.39	700.09	700.23	700.30	700.34
13.50	DISCHG	7.24	7.28	7.294	8.936	26.02	79.46	164.765	267.61	359.17	409.64
13.50	ELEV	700.72	700.92	700.99	701.25	701.48	701.72	701.91	702.12	702.39	702.56
16.00	DISCHG	1257.606	1404.37	1277.12	1031.66	873.317	785.31	706.64	638.74	588.549	559.71
16.00	ELEV	702.86	702.93	702.87	702.75	702.65	702.58	702.51	702.45	702.41	702.37
18.50	DISCHG	442.91	330.69	276.449	230.87	193.19	162.62	138.050	118.36	102.80	97.02
18.50	ELEV	702.29	702.20	702.10	702.02	701.96	701.90	701.86	701.82	701.79	701.77
21.00	DISCHG	91.761	86.97	82.62	78.66	75.062	71.79	68.81	66.14	63.853	61.85
21.00	ELEV	701.761	701.74	701.73	701.71	701.70	701.69	701.68	701.67	701.66	701.66
23.50	DISCHG	60.05	58.40	56.794	54.79	51.68	47.68	43.582	39.92	36.54	35.43
23.50	ELEV	701.65	701.65	701.64	701.63	701.62	701.61	701.60	701.57	701.55	701.55
26.00	DISCHG	30.592	27.99	25.60	23.43	21.432	19.61	17.94	16.41	15.022	13.74
26.00	ELEV	701.51	701.49	701.48	701.46	701.45	701.44	701.43	701.42	701.41	701.40

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 10.4189 CFS-HRS= 3696.24 ACRE-FT= 340.62

ENDCMP 1

END OF JOB TR20 GGJ
BATCH JOB
JOB NUMBER 78/3095 PHASE 0
DATE RAN 10/ 5/78 QUEUE 107

HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1968

HR-20 ROUTING. 100-Yr.

MO DAM INSP-ELLIOT DAVIS DAM
EXECUTIVE CONTROL CARD OPERATION LIST

MO DAM INSP-ELLIOT DAVIS DAM

C TABLE VELOCITY INCREMENT = 0.200

8	0.0000	0.0800	0.1800	0.2800	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6900	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9300	0.9300
9 ENDTBL					

STRUCTURE NO. 1

	ELEVATION	DISCHARGE	STORAGE
8	699.0001	0.0000	777.9998
9 ENDTBL			

DIMENSIONLESS HYDROGRAPH - DELTA T =484.00

8	0.0000	0.0300	0.1000	0.1900	0.3100
8	0.4700	0.6600	0.8200	0.9300	0.9900
8	1.0000	0.9900	0.9300	0.8600	0.7800
8	0.6800	0.5600	0.4600	0.3900	0.3300
8	0.2800	0.2410	0.2070	0.1740	0.1470
8	0.1260	0.1070	0.0910	0.0770	0.0660
8	0.0550	0.0470	0.0400	0.0340	0.0290
8	0.0250	0.0210	0.0180	0.0150	0.0130
8	0.0110	0.0090	0.0080	0.0070	0.0060
8	0.0050	0.0040	0.0030	0.0020	0.0010
8	0.0000	0.0000	0.0000	0.0000	0.0000
9 ENDTBL					

RAINFALL TABLE NO. 1 TIME INCREMENT = 0.50

8	0.0000	0.0080	0.0170	0.0260	0.0350
8	0.0450	0.0550	0.0650	0.0760	0.0870
8	0.0990	0.1120	0.1250	0.1400	0.1560
8	0.1740	0.1940	0.2190	0.2540	0.3030
8	0.5150	0.5830	0.6240	0.6540	0.6820
8	0.7050	0.7270	0.7480	0.7670	0.7840
8	0.8000	0.8160	0.8300	0.8440	0.8570
8	0.8700	0.8820	0.8930	0.9050	0.9160
8	0.9260	0.9360	0.9460	0.9550	0.9650
8	0.9740	0.9830	0.9920	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 2 TIME INCREMENT = 0.02

8	0.0000	0.0100	0.0200	0.0200	0.0300
8	0.0400	0.0500	0.0600	0.0700	0.0800
8	0.1000	0.1100	0.1300	0.1400	0.1700
8	0.1900	0.2200	0.2700	0.3500	0.4400
8	0.5200	0.6000	0.6300	0.6500	0.6800
8	0.7000	0.7200	0.7400	0.7600	0.7700
8	0.7900	0.8000	0.8200	0.8300	0.8400
8	0.8500	0.8700	0.8800	0.8900	0.9000
8	0.9100	0.9200	0.9300	0.9400	0.9500
8	0.9567	0.9633	0.9700	0.9800	0.9900
8	1.0000	1.0000	1.0000	1.0000	1.0000
9 ENDTBL					

RAINFALL TABLE NO. 3 TIME INCREMENT = 0.50

8	0.0000	0.0300	0.0600	0.0900	0.1200

```
8          0.1500    0.1800    0.2100    0.2400    0.2700
8          0.3000    0.3300    0.3600    0.4400    0.5200
8          0.6000    0.6800    0.7600    0.8500    0.9300
8          1.0200    1.1000    1.1900    1.2700    1.3600
8          1.6300    1.9000    2.2200    2.5500    2.9500
8          3.3600    4.3800    5.4100    5.7900    6.1700
8          6.4600    6.7600    6.8000    6.8500    6.8900
8          6.9400    6.9800    7.0300    7.0700    7.1200
8          7.1600    7.2100    7.2500    7.3000    7.3000
9 ENDTBL
```

STANDARD CONTROL INSTRUCTIONS

			HYDROGRAPHS						OUTPUT OPTIONS					
SUBRTN	XSECTN	STRCT	IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	PK	H	L	V	PH	SM
RUNOFF	0	1	0	0	6	0.550	79.000	0.520	1	1	0	1	0	0
RESVOR	0	1	6	0	7	699.000	0.000	0.000	1	1	1	1	0	0
ENDATA														

END OF LISTING

ADDITIONS TO TABULAR DATA FOLLOW

STRUCTURE NO. 1

8	699.0001	0.0000	778.0001
8	699.2000	3.1000	788.0001
8	699.4000	7.1000	800.0001
8	699.6000	7.1000	805.0001
8	700.0001	7.1000	828.0001
8	700.5001	7.2000	855.0001
8	701.0001	7.3000	881.0001
8	701.2000	7.3000	895.0001
8	701.4000	13.3000	907.0001
8	701.6000	43.4000	914.0001
8	701.8000	103.0000	927.0001
8	702.2000	327.0000	948.0001
8	702.7000	928.0001	977.0001
8	703.2000	1937.0002	1005.0001
8	704.2000	6121.0009	1062.0002

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 0.25
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 0/ 1 TO XSECTN/STRUCT 0/ 1
STARTING TIME= 0.00 RAIN DEPTH= 1.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 3 SOIL CONDITION= 3
ALTERNATE NO.= 1 STORM NO.= 1

SUBROUTINE RUNOFF STRUCTURE 1
AREA= 0.55 INPUT RUNOFF CURVE= 79.0 TIME OF CONCENTRATION= 0.52
COMPUTED CURVE NO. = 90.4

100-year

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
9.29	36.551	(RUNOFF)
10.22	40.975	(RUNOFF)
11.18	44.352	(RUNOFF)
15.93	689.505	(RUNOFF)
20.09	33.163	(RUNOFF)
21.09	33.181	(RUNOFF)
22.08	33.193	(RUNOFF)
23.08	33.265	(RUNOFF)
23.94	33.115	(RUNOFF)

HYDROGRAPH, TZERO= 4.25 DELTA T= 0.25 DRAINAGE AREA= 0.55

TIME										
4.25	DISCHG	0.00	1.25	1.78	2.29	2.79	3.26	3.72	4.21	6.82	12.14
6.75	DISCHG	15.96	18.77	21.11	23.19	25.07	26.78	28.36	29.84	32.19	35.43
9.25	DISCHG	36.52	36.00	37.39	40.27	40.96	39.91	41.07	43.84	44.28	42.86
11.75	DISCHG	43.87	47.30	73.32	121.24	144.84	154.80	167.61	185.54	196.53	204.54
14.25	DISCHG	219.93	244.09	257.37	267.82	371.50	565.29	653.64	685.31	590.02	389.63
16.75	DISCHG	302.84	275.09	251.18	220.04	208.64	207.78	163.43	80.03	45.88	37.74
19.25	DISCHG	33.87	29.98	30.16	32.91	32.49	29.67	30.16	32.95	32.50	29.75
21.75	DISCHG	30.16	32.97	32.51	29.76	30.19	33.02	32.54	29.74	30.21	32.80
24.25	DISCHG	25.63	9.87	3.13	0.97	0.28	0.05	0.00	0.00		

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 6.1579 (7.3 / 1.14) CFS-HRS= 2165.77 ACRE-FT= 180.53

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 699.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
18.43	110.931	701.81

HYDROGRAPH, TZERO= 4.25 DELTA T= 0.25 DRAINAGE AREA= 0.55

TIME										
4.25	DISCHG	0.00	0.00	0.01	0.02	0.04	0.06	0.08	0.10	0.14	0.20
4.25	ELEV	699.00	699.00	699.00	699.00	699.00	699.00	699.00	699.00	699.00	699.01
6.75	DISCHG	0.29	0.39	0.52	0.66	0.81	0.97	1.14	1.32	1.51	1.71
6.75	ELEV	699.01	699.02	699.03	699.04	699.05	699.06	699.07	699.08	699.09	699.11
9.25	DISCHG	1.93	2.15	2.37	2.60	2.85	3.09	3.34	3.61	3.89	4.16
9.25	ELEV	699.12	699.13	699.15	699.16	699.18	699.19	699.21	699.22	699.25	699.25
11.75	DISCHG	4.43	4.71	5.09	5.73	6.60	7.09	7.09	7.09	7.09	7.09
11.75	ELEV	699.26	699.28	699.29	699.43	699.37	699.39	699.39	699.39	699.39	699.39
14.25	DISCHG	7.09	7.09	7.10	7.12	7.15	7.18	7.23	7.26	7.27	7.31
14.25	ELEV	699.39	699.39	700.03	700.13	700.35	700.42	700.50	700.42	700.44	701.23
16.75	DISCHG	13.87	37.27	57.51	73.44	86.18	97.21	107.35	116.61	102.15	95.70
16.75	ELEV	701.40	701.55	701.64	701.70	701.74	701.78	701.80	701.81	701.73	701.77

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19.25	DISCHG	91.19	85.83	80.79	76.33	72.38	68.65	65.14	62.11	59.45	56.89
19.25	ELEV	701.76	701.74	701.72	701.71	701.69	701.68	701.67	701.66	701.65	701.64
21.75	DISCHG	54.45	52.38	50.60	48.84	47.13	45.73	44.56	43.35	42.21	41.30
21.75	ELEV	701.63	701.63	701.62	701.61	701.61	701.60	701.60	701.59	701.59	701.58
24.25	DISCHG	40.27	38.36	35.65	32.79	30.05	27.51	25.17	23.03	21.07	19.28
24.25	ELEV	701.57	701.56	701.54	701.52	701.51	701.49	701.47	701.46	701.45	701.43
26.75	DISCHG	17.64	16.13	14.76	13.50	13.18	13.05	12.91	12.78	12.65	12.52
26.75	ELEV	701.42	701.41	701.40	701.40	701.39	701.39	701.38	701.38	701.37	701.37

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.8151 CFS-HRS= 644.29 ACRE-FT= 53.24

ENDCMP 1

HOSKINS-WESTERN-SONDEREGGER

COMPUTED BY SSJ DATE 10/3/79 SHEET NO. 1 OF 4

CHECKED BY _____ DATE _____ JOB NUMBER 79-3005

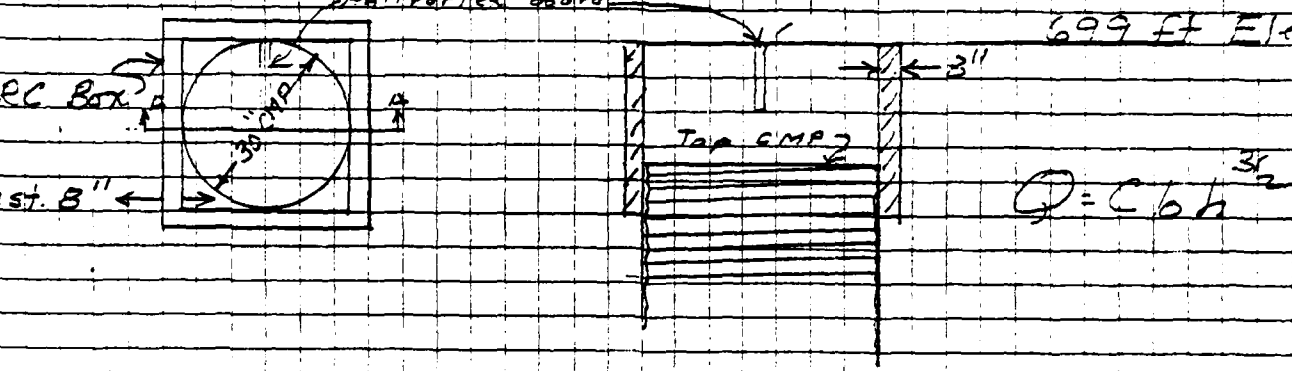
CALCULATIONS FOR

PROJECT _____

Flow over Prime. Spillway - Drop Inlet

Elliot Davis Dam T.V.A.

Concrete Box over 30" CMP



Crest length = 4 x 30" = 120" = 10 ft

C = 3.5 from C of E Hyd Chan. of Rec. Outlet Inlets

699+ h	Q
.2	3
.4	9
.6	16
1.0	35
1.5	64
2.0	99
2.5	138
3.0	182
4.0	280
5.0	391

HOSKINS-WESTERN-SONDEREGGER

CALCULATIONS FOR

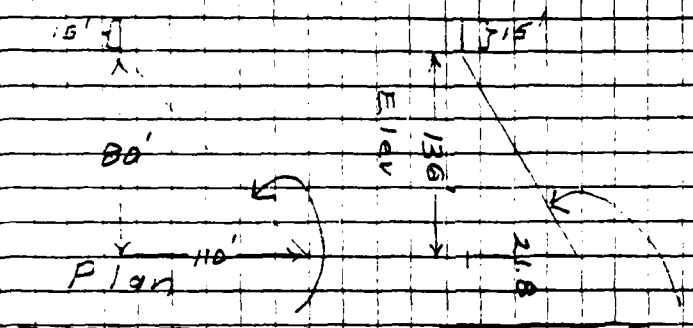
Flow Thru 12" Pipe

COMPUTED BY GGJ DATE 10/3/78 SHEET NO. 1 OF 1

CHECKED BY _____ DATE _____ JOB NUMBER 3005

PROJECT Dam Enlg.

Elliot Davis Dam #10129



$\sqrt{80^2+110^2} = 136'$ $\sqrt{136^2+21.8^2} = 138'$

138
+15
$L_e = 153'$ total length

695.3 Invert @ drop inlet
− 673.5 Invert @ end of pipe
21.8 Total drop

699.0 Spillway Crest
673.5 Invert @ end of pipe
25.5 − 5' = 25' = Hd on pipe with water at crest elev.

General Equation: $Q = A\sqrt{\frac{2gh}{1+\Sigma K}}$

$1+\Sigma K = 1 + K_o + K_b + \left[\left(\frac{2A_c}{A_r+A_e}\right)^2 L_r + \left(\frac{2A_c}{A_e+A_c}\right)^2 L_e + L_c\right] K_e$

From Engr. H.B. Sec. 5

$K_o = 0.5 \quad K_b = 1.0 \quad K_e = .1157$

A_c = Area of conduit (12") = $\pi r^2 = \pi(.5)^2 = .785$ sq. ft

A_r = Area of riser (30") = $\pi r^2 = \pi(1.25)^2 = 4.91$ sq. ft.

$A_r = A_e$

$L_r = 699.0 - 695.2 = 3.7' - 1.0 = 2.7'$

$L_c = 153'$

$L_e = .5 + 1.25 = 1.75$

$1+\Sigma K = 1 + 0.5 + 1.0 + \left[\left(\frac{11.57}{9.82}\right)^2 (2.7) + \left(\frac{1.57}{5.695}\right)^2 (1.75) + 153\right] .1157$

$= 2.5 + 17.72 = 20.22$

HOSKINS-WESTERN-SONDEREGGER

COMPUTED BY SSV DATE 10/4/78 SHEET NO. 3 OF 4

CHECKED BY _____ DATE _____ JOB NUMBER 78/2095

PROJECT _____

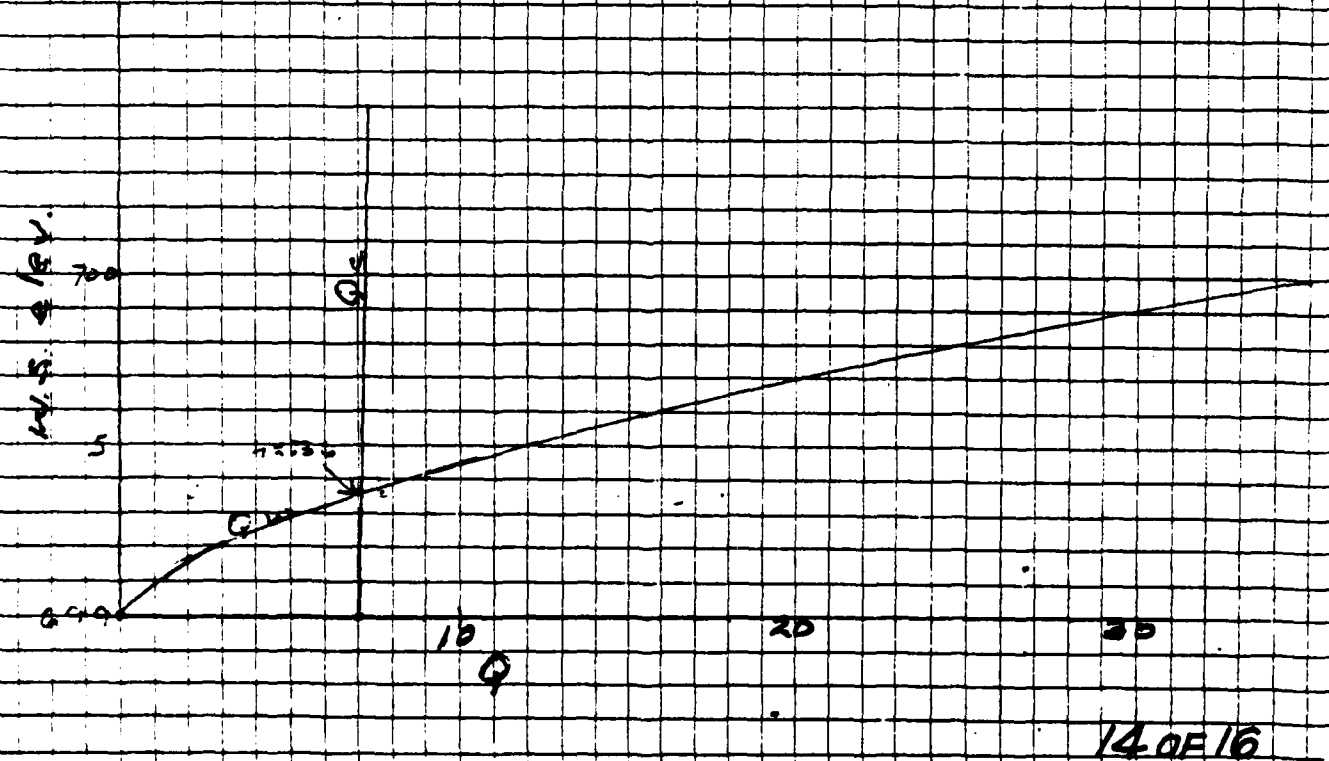
CALCULATIONS FOR

Flow thru 12" Pipe

$$Q_c = F_c \sqrt{\frac{2g}{1+2F_c}}\ \sqrt{h}$$

$$Q_c = .785 \sqrt{\frac{64.32}{20.22}}\ \sqrt{h} \quad = 1.4\ h^{1/2}$$

Elev.	h_w	$h_c = h_w + .25$	$Q_c = 1.4\ h_c^{1/2}$
699		.25	0.70
699+	.2	.25.2	7.03
	.4	.25.4	7.06
	.6	.25.6	7.08
	1.0	26.0	7.14
	1.5	26.5	7.21
	2.0	27.0	7.27
	2.5	27.5	7.34
702	3.0	28.0	7.41
703	4.0	29.0	7.54
	5.0	30.0	7.67



HOSKINS-WESTERN-SONDEREGGER

COMPUTED BY _____ DATE _____ SHEET NO. 7 OF 7

CHECKED BY _____ DATE _____ JOB NUMBER _____

PROJECT _____

CALCULATIONS FOR Flow over Embankment

$Q = C b h^{3/2}$

#10129

Use TWRI, Bk. 3, Ch. A-5

Sta.	Dist. b	Road Elev.	Top. of Dam Elev.	Depth h	Mn Depth h	Mean h^3/2	C Gravel	Q
~~1+55~~		7042	~~7046.0~~ 7042	0				
	55				1.1	5.15	2.85	131
0			7020	2.2				
	100				2.25		3.00	1012
1+00			7019	2.3				
	100				1.85		2.97	747
2+00			7028	1.4				
	100				1.30		2.89	428
3+00			7030	1.2				
	100				.65		2.73	143
4+00			7041	.1				
	100				.25		2.60	32
5+00			7038	.4				
	100				.7		2.75	161
6+00			7032	1.0				
	100				1.05		2.84	306
7+00			7031	1.1				
	100				1.0		2.83	283
8+00			7033	.9				
	100				1.8		2.96	715
9+00			7015	2.7				
	100				2.85		3.04	1463
10+00			7012	3.0				
	50				2.45		3.02	579
10+50			7023	1.9				
~~11+74~~	~~50~~				.95		2.82	63
~~11+00~~		7042	~~7042~~ 7042	0				
				(3.0)				6118

15 OF 16

SKINS-WESTERN-SONDEREGGER

COMPUTED BY GGJ DATE 10/21-23 SHEET NO. 4 OF 4

CHECKED BY _____ DATE _____ JOB NUMBER 78/309.5

CALCULATIONS FOR

PROJECT _____

Total Outflow Rating Elliot Davis # 10129

Elev.	H	Qw	Qc	Qr	Qtotal	
699.2	.2	3.1	~~7~~		3.1	
4	.4	~~9~~	7.1		7.1	
.6	.6	~~16~~	7.1		7.1	
700	1.0		7.1		7.1	
700.5	1.5		7.2		7.2	
701	2.0		7.3		7.3	
701.2			7.3	0	7.3	Low pt on Dam
701.4			7.3	6	13.3	
701.6			7.4	36	43.4	
701.8			7.4	96	103.0	
702.2			7.4	320	327.0	
702.7			7.4	721	928.0	
703.2			7.5	1929	1937.0	
704.2			7.5	6113	6121.0	

16 OF 16

END

DATE
FILMED

11-81

DTIC